

## **CHAPTER 6**

### **RESTORATION STRATEGIES IN THE LOWER TENNESSEE RIVER WATERSHED**

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#### **6.1. BACKGROUND.**

The Watershed Water Quality Management Plan serves as a comprehensive inventory of resources and stressors in the watershed, a recommendation for control measures, and a guide for planning activities in the next five-year watershed cycle and beyond. Water quality improvement will be a result of implementing both regulatory and nonregulatory programs.

In addition to the NPDES program, some state and federal regulations, such as the TMDL and ARAP programs, address point and nonpoint issues. Construction and MS4 storm water rules (implemented under the NPDES program) have transitioned from Phase 1 to Phase 2. More information on storm water rules may be found at: <http://www.state.tn.us/environment/wpc/stormh2o/MS4.htm>.

This Chapter addresses point and nonpoint source approaches to water quality problems in the Tennessee portion of the Lower Tennessee River Watershed.

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**6.2. COMMENTS FROM PUBLIC MEETINGS.** Watershed meetings are open to the public, and most meetings were represented by citizens who live in the watershed, NPDES permittees, business people, farmers, and local river conservation interests. Locations for meetings were chosen after consulting with people who live and work in the watershed. Everyone with an interest in clean water is encouraged to be a part of the public meeting process. The times and locations of watershed meetings are posted at: <http://www.state.tn.us/environment/wpc/watershed/public.shtml>.

**6.2.A. Year 1 Public Meeting.** The first Lower Tennessee River Watershed public meeting was held March 21, 1999 at the Chattanooga Environmental Field Office in Chattanooga. The goals of the meeting were to: (1) present, and review the objectives of, the Watershed Approach, (2) introduce local, state, and federal agency and nongovernmental organization partners, (3) review water quality monitoring strategies, and (4) solicit input from the public.

Major Concerns/Comments

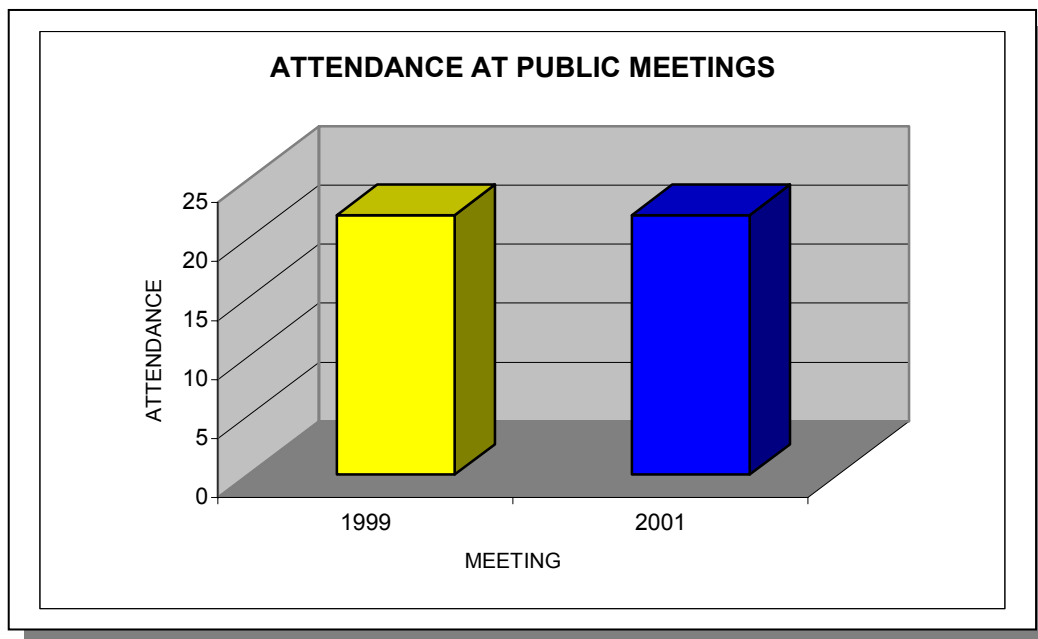
- Increasing amount of sediment in streams
- Impacts of urbanization
- Problems related to industrial forestry
- Loss of vegetative buffer strips as TVA opens shorelines to development
- Rate of urban sprawl in Hamilton County
- Pressures on STPs from unplanned development
- Chickamauga dam expansion and the increased extraction of natural resources that will follow
- Lack of incentive for single family residences to be good land stewards
- Nutrient loading in Nickajack Lake

**6.2.B. Year 3 Public Meeting.** The second Lower Tennessee River Watershed public meeting was held December 11, 2001 at the Environmental Assistance Center in Chattanooga. The goals of the meeting were to: (1) provide an overview of the watershed approach, (2) review the monitoring strategy, (3) summarize the most recent water quality assessment, (4) discuss the TMDL schedule and citizens' role in commenting on draft TMDLs, and (5) discuss BMPs and other nonpoint source tools available through the Tennessee Department of Agriculture 319 Program and NRCS conservation assistance programs.

Major Concerns/Comments

- Several comments about lack of manpower to do adequate monitoring
- Firebreaks (from bulldozers) in response to forest fires cause sediment to get into streams
- Silt from clear cuts gets to second order streams
- Not enough protection of threatened and endangered species

**6.2.C.** Year 5 Public Meeting. Not yet scheduled.



**Figure 6-1. Attendance at the Lower Tennessee River Watershed Public Meetings.**  
*Attendance numbers do not include TDEC personnel.*

### **6.3. APPROACHES USED.**

**6.3.A. Point Sources.** Point source contributions to stream impairment are primarily addressed by NPDES and ARAP permit requirements and compliance with the terms of the permits. Notices of NPDES and ARAP draft permits available for public comment can be viewed at <http://www.state.tn.us/environment/wpc/wpcppo/>. Discharge monitoring data submitted by NPDES-permitted facilities may be viewed at [http://www.epa.gov/enviro/html/pes/pes\\_query\\_java.html](http://www.epa.gov/enviro/html/pes/pes_query_java.html).

The purpose of the TMDL program is to identify remaining sources of pollution and allocate pollution control needs in places where water quality goals are still not being achieved. TMDL studies are tools that allow for a better understanding of load reductions necessary for impaired streams to return to compliance with water quality standards. More information about Tennessee's TMDL program may be found at: <http://www.state.tn.us/environment/wpc/tmdl/>.

Approved TMDL:

**Lower Tennessee River.** A Total Maximum Daily Load for pH and Iron in North and South Suck Creek in the Lower Tennessee River Watershed in Bledsoe, Bradley, Hamilton, Loudon, Marion, McMinn, Meigs, Rhea, Roane, and Sequatchie Counties. Approved July 7, 2006.

<http://www.state.tn.us/environment/wpc/tmdl/approvedtmdl/LowerTnEcoli.pdf>

**North and South Suck Creek.** A Total maximum Daily Load for pH and Iron in North and South Suck Creek in the Lower Tennessee River Watershed in Hamilton, Marion, and Sequatchie Counties. Approved August 16, 2006.

<http://www.state.tn.us/environment/wpc/tmdl/approvedtmdl/SuckCreekPH&Iron.pdf>

**Lower Tennessee River.** Total Maximum Daily Load for Siltation and Habitat Alteration in the Lower Tennessee River Watershed in Bledsoe, Bradley, Hamilton, Loudon, Marion, McMinn, Meigs, Rhea, Roane, and Sequatchie Counties. Approved September 25, 2006.

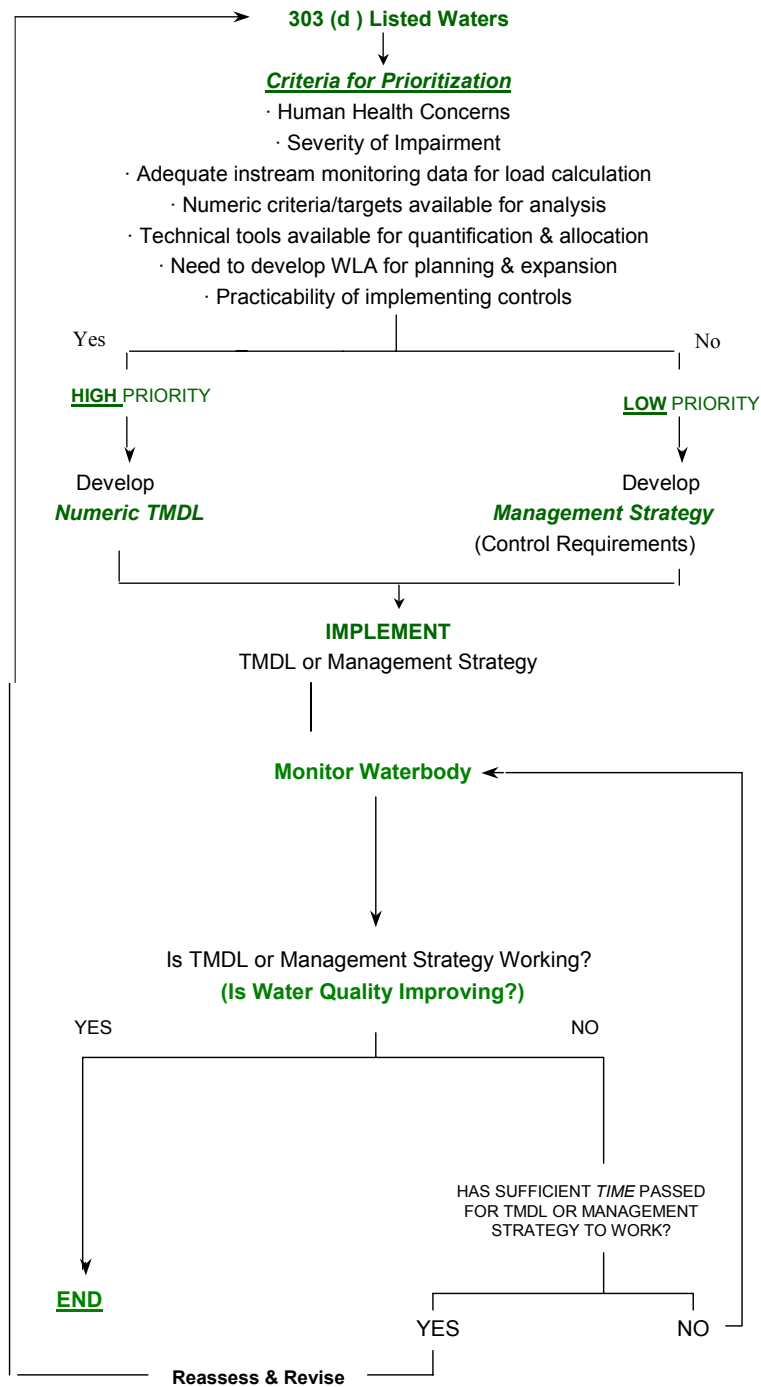
<http://www.state.tn.us/environment/wpc/tmdl/approvedtmdl/LowerTnSed.pdf>

**North Chickamauga Creek.** A Total Maximum Daily Load for pH for North Chickamauga Creek in the Tennessee River Watershed. Approved March 17, 2005.

<http://www.state.tn.us/environment/wpc/tmdl/approvedtmdl/NChickFinal.pdf>

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TMDLs are prioritized for development based on many factors.



**Figure 6-2. Prioritization Scheme for TMDL Development.**

### **6.3.B. Nonpoint Sources**

Common nonpoint sources of pollution in the Lower Tennessee River Watershed include urban storm water runoff, riparian vegetation removal and other habitat alterations, inappropriate land development, off road vehicles, poor road construction practices, acid mine drainage from historical mine and rock harvesting sites, and inappropriate agricultural practices. Since nonpoint pollution exists essentially everywhere rain falls, existing point source regulations can have only a limited effect. Other measures are, therefore, necessary.

There are several state and federal regulations that address contaminants impacting waters in the Lower Tennessee River Watershed, specifically the tributaries flowing into Nickajack Lake as well as Nickajack Lake itself. Most of these are limited to point sources: a pipe or ditch. Often, controls of point sources are not sufficient to protect waters, so other measures are necessary. Some measures include efforts by landowners and volunteer groups and the possible implementation of new regulations. Many agencies, such as the Tennessee Department of Agriculture (TDA) and the Natural Resources Conservation Service (NRCS), offer financial assistance to landowners for corrective actions (like Best Management Practices) that may be sufficient for recovery of impacted streams. Many nonpoint problems will require an active civic involvement at the local level geared towards establishment of improved zoning guidelines, building codes, streamside buffer zones and greenways, and general landowner education. Other problem sources, such as acid mine drainage, require assistance from the Office of Surface Mining and Remediation in order for the streams affected by acid mine drainage to meet water quality standards.

The following text describes types of impairments, possible causes, and suggested improvement measures. Restoration efforts should not be limited to only those streams and measures suggested below.

#### **6.3.B.i. Sedimentation.**

**6.3.B.i.a. From Construction Sites.** Construction activities have historically been considered “nonpoint sources.” In the late 1980’s, EPA designated them as being subject to NPDES regulation if more than 5 acres were being disturbed. In the spring of 2003, that threshold became 1 acre. The general permit issued for such construction sites establishes conditions for maintenance of the sites to minimize pollution from storm water runoff, including requirements for installation and inspection of erosion prevention and sediment controls. Also, the general permit imposes more stringent inspection, design criteria, sediment control measures, and self-monitoring requirements on sites in the watershed of streams that are already impaired due to sedimentation or are considered high quality. Regardless of the size, no construction site is allowed to cause a condition of pollution. Examples of streams impaired by sediment and land development in the Lower Tennessee River Watershed are Friar Branch, South Chickamauga Creek, and Mountain Creek.

Beginning in 2003, the state began requiring some municipalities to obtain coverage under a permit designed to address nonpoint runoff issues: the General NPDES Municipal Separate Storm Sewer System Permit, commonly known as MS4. This permit requires the holder to develop a comprehensive storm water management program,

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including the adoption of local regulatory ordinances, regular inspection of construction sites and other discharges into their storm sewers, and a variety of educational, mapping, and monitoring activities. The state audits and oversees these local MS4 programs.

Construction sites within a sediment-impaired watershed may also have higher priority for inspections by WPC and MS4 personnel, and are likely to have enforcement actions for failure to control erosion.

**6.3.B.i.b.** From Channel and/or Bank Erosion. Many streams within the Lower Tennessee River Watershed suffer from varying degrees of streambank erosion. When stream channels are altered, banks can become unstable and highly erodible. Heavy livestock traffic can also severely disturb banks. When large tracts of land are cleared of vegetation (especially trees) and replaced with impermeable surfaces like asphalt and rooftops, the large increases in the velocities and volumes of stormwater runoff can also overwhelm channel and bank integrity because destabilized banks contribute to sediment loadings and to the loss of beneficial riparian vegetation. Some inappropriate agricultural practices and overzealous land development have impacted the hydrology and morphology of stream channels in this watershed.

Unpermitted rock harvesting can also severely disturb stream banks. Destabilized banks contribute to sediment load and to the loss of beneficial riparian vegetation to the stream. The historical removal of cobble and rock from stream channels has resulted in destabilization of stream channels and aggressive erosion of stream banks.

Several agencies such as the NRCS, TVA, and TDA, as well as citizen watershed groups, are working to stabilize portions of stream banks using bioengineering and other techniques. Many of the affected streams could benefit from these types of projects.

Some methods or controls that might be necessary to address common problems are:

*Voluntary Activities*

- Re-establish bank vegetation (Citico Creek, Friar Branch, Rogers Branch, Dobbs Branch, Gillespie Springs Branch, Chattanooga Creek, Stringers Branch, Mountain Creek, and unnamed tributaries to South Chickamauga Creek, North Chickamauga Creek, Citico Creek, and Chattanooga Creek).
- Increase efforts in the Master Logger Program to recognize impaired streams and require more effective management practices.
- Better community planning for the impacts of development on small streams, especially development in growing areas (Friar Branch, Hurricane Creek, Lick Branch, Mountain Creek).
- Establish off-channel watering areas for livestock by moving watering troughs and feeders back from stream banks, or at least limit cattle access to restricted areas with armored bank entry.
- Limit cattle access to streams and bank vegetation.

### *Regulatory Strategies*

- Restrict rock harvesting to permitted sites.
- Require post-construction run-off rates to be no greater than pre-construction rates in order to avoid in-channel erosion (all MS4 areas should establish these ordinances).
- Limit clearing of stream and ditch banks or other alterations. *Note: Permits may be required for any work along streams.*
- Implement additional restrictions on logging in streamside management zones (North Chickamauga Creek).
- Restrict the use of off-highway vehicles on stream banks and in stream channels (upper portions of the North Chickamauga Creek Watershed, North Suck Creek Watershed, Mullens Creek Watershed, Conner Creek Watershed).

### *Additional Strategies*

- Better community planning and MS4 oversight for the impacts of development on small streams, especially development in growing areas.
- Encourage or require strong local buffer ordinances.
- Restrict the use of off-highway vehicles on stream banks and in stream channels.
- Limit road and utility crossings of streams through better site design.

**6.3.B.i.c.** From Agriculture and Silviculture. The Water Quality Control Act exempts normal agricultural and silvicultural practices that do not result in a point source discharge. Nevertheless, efforts are being made to address impacts due to these exempted practices.

The Master Logger Program has been in place for several years to train loggers how to install Best Management Practices that lessen the impact of logging activities on streams. Recently, laws and regulations were enacted which established that these BMPs must be used or the Commissioners of the Departments of Environment and Conservation and of Agriculture would be permitted to stop the logging operation that, upon failing to install these BMPs, was causing impacts to streams.

Since the Dust Bowl era, the agriculture community has strived to protect the soil from wind and water erosion. Agencies such as the Natural resources Conservation Service (NRCS), the University of Tennessee Agricultural Extension Service, and the Tennessee Department of Agriculture have worked to identify better ways of farming, to educate the farmers, and to install the methods that address the sources of some of the impacts due to agriculture. Cost sharing is available for many of these measures.

Many sediment problems traceable to agricultural practices also involve riparian loss due to close row cropping or pasture clearing for grazing. Lack of vegetated buffers along stream corridors is a problem in some areas of the Lower Tennessee River Watershed, due both to agricultural and residential/commercial land uses. Many streams could benefit from the establishment of more extensive riparian buffer zones.



### **6.3.B.ii. Pathogen Contamination.**

Possible sources of pathogens are inadequate or failing septic tank systems, overflows or breaks in public sewer collection systems, poorly disinfected discharges from sewage treatment plants, and fecal matter from pets, livestock and wildlife washed into streams and storm drains. When fecal bacterial levels are shown to be consistently elevated to dangerously high levels, especially in streams with high potential for recreational uses, the division must post signage along the creek warning the public to avoid contact. Once pathogen sources have been identified and corrected, and pathogen level reductions are documented, the posting is lifted.

Permits issued by the Division of Water Pollution Control regulate discharges from point sources and require adequate control for these sources. Individual homes are required to have subsurface, on-site treatment (i.e., septic tank and field lines) if public sewers are not available. The Division of Ground Water Protection within the Chattanooga Environmental Field Office and delegated county health departments regulate septic tanks and field lines. In addition to discharges to surface waters, businesses may employ subsurface treatment for domestic wastewater or surface discharge of treated process wastewater. The Division of Water Pollution Control regulates surface water discharges and near-surface land application of treated wastewater.

Currently, seventeen streams in the Tennessee portion of the Lower Tennessee River Watershed are known to have excessive pathogen contamination. North Market Street Branch, Friar Branch, Spring Creek, West Chickamauga Creek, South Chickamauga Creek, Citico Creek, Dobbs Branch, Chattanooga Creek, Stringers Branch, Gillespie Springs Branch, and unnamed tributaries to South Chickamauga Creek, Citico Creek, and Chattanooga Creek are impacted by urban areas, with contributions of bacterial contamination coming from storm water runoff, sewage collection system leaks, and treatment plant operation failures originating from the Chattanooga area. In the Signal Mountain area, numerous failing septic tank systems affect Shoal Creek, Short Creek, and Bee Creek. McFarland Springs Branch and a portion of South Chickamauga Creek are impacted Georgia before they flow into Tennessee. Therefore, it is necessary to involve the Georgia Environmental Protection Division in order for these streams to reach attainment status.

Some measures that may be necessary to control pathogens are:

#### *Voluntary Activities*

- Clean up pet waste.
- Develop and enforce leash laws and controls on pet fecal material.
- Repair failed septic systems.
- Off-channel watering of livestock.
- Limit livestock access to streams.
- Improve and educate on the proper management of animal waste from confined feeding operations.

#### *Regulatory Strategies*

- Strengthen enforcement of regulations governing on-site wastewater treatment.

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- Determine timely and appropriate enforcement for non-complying sewage treatment plants, large and small, and their collection systems.
- Identify Concentrated Animal Feeding Operations not currently permitted.
- Develop and enforce leash laws and controls on pet fecal material.
- Review the pathogen limits in discharge permits to determine the need for further restriction.

*Additional Strategies*

- Develop intensive planning in areas where sewer is not available and treatment by subsurface disposal is not an option due to poor soils, floodplains, or high water tables.
- Greater efforts by sewer utilities to identify leaking lines or overflowing manholes (example: Cities of Waynesboro, Hohenwald, and Linden).

**6.3.B.iii. Excessive Nutrients and/or Dissolved Oxygen Depletion.**

These two impacts are usually listed together because high nutrients often contribute to low dissolved oxygen within a stream. Since nutrients often have the same source as pathogens, the measures previously listed can also address many of these problems. Elevated nutrient loadings are also often associated with urban runoff from impervious surfaces, from fertilized lawns and croplands, and faulty sewage disposal processes. Nutrients are often transported with sediment, so many of the measures designed to reduce sediment runoff will also aid in preventing organic enrichment of streams and lakes.

Dissolved oxygen depletion can also be due to the discharge of other biodegradable materials. These are limited in NPDES permits as ammonia and as either Biological Oxygen Demand (BOD) or Carbonaceous Oxygen Demand (CBOD).

Some sources of nutrients can be addressed by:

*Voluntary Activities*

- Educate homeowners and lawn care companies in the proper application of fertilizers.
- Encourage landowners, developers, and builders to leave stream buffer zones. Streamside vegetation can filter out many nutrients and other pollutants before they reach the stream. These riparian buffers are also vital along livestock pastures. Examples of streams that can benefit are Citico Creek, South Chickamauga Creek, Lick Branch, Friar Branch, and Rogers Branch.
- Use grassed drainage ways that can remove fertilizer before it enters streams.
- Use native plants for landscaping since they don't require as much fertilizer and water.
- Better overall storm water management in urban and residential areas, including retrofitting existing commercial lots, homes, and roadways with storm water quality and quantity BMPs. This would especially improve the urban streams and lakes currently polluted by excessive nutrient inputs.

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Physical changes to streams can prevent them from providing enough oxygen to biodegrade the materials that are naturally present. A few additional actions can address this problem:

- Maintain shade over a stream. Cooler water can hold more oxygen and retard the growth of algae. As a general rule, all stream channels suffer from some canopy removal. An intact riparian zone also acts as a buffer to filter out nutrient loads before they enter the water.
- Discourage impoundments. Ponds and lakes do not aerate water. *Note: Permits may be required for any work on a stream, including impoundments.*

***Regulatory Strategies***

- Strengthen enforcement of regulations governing on-site wastewater treatment.
- Impose more stringent permit limits for nutrients discharged from sewage treatment plants.
- Timely and appropriate enforcement for noncomplying sewage treatment plants, large and small, and their collection systems.
- Identify Concentrated Animal Feeding Operations (CAFO) not currently permitted.
- Identify any Animal Feeding Operations (AFO) that contribute to stream impacts and declare them as a CAFO requiring a permit.
- Support and train local MS4 programs within municipalities to deal with storm water pollution issues and require additional storm runoff quality control measures.
- Require nutrient management plans for all golf courses.

***Additional Strategies***

- Encourage TDA- and NRCS-sponsored educational programs targeted to agricultural landowners and aimed at better nutrient management, as well as information on technology-based application tools.

**6.3.B.iv. Toxins and Other Materials.**

Although some toxic substances are discharged directly into waters of the state from a point source, much of these materials are washed in during rainfalls from an upland location, or via improper waste disposal that contaminates groundwater. In the Tennessee portion of the Lower Tennessee River Watershed, a relatively small number of streams are damaged by storm water runoff from industrial facilities or urban areas. More stringent inspection and regulation of permitted industrial facilities, and local storm water quality initiatives and regulations, could help reduce the amount of contaminated runoff reaching state waters.

Individuals may also cause contaminants to enter streams by activities that may be attributed to apathy or the lack of knowledge or civility. Litter in roadside ditches, garbage bags tossed over bridge railings, paint brushes washed off over storm drains, and oil drained into ditches are all blatant examples of pollution in streams.

Some of these problems can be addressed by:

*Voluntary Activities*

- Provide public education.
- Paint warnings on storm drains that connect to a stream.
- Sponsor community clean-up days.
- Landscape public areas.
- Encourage public surveillance of their streams and reporting of dumping activities to their local authorities.

*Regulatory Strategies*

- Continue to prohibit illicit discharges to storm drains and to search them out.
- Strengthen litter law enforcement at the local level.
- Increase the restrictions on storm water runoff from industrial facilities.

**6.3.B.v. Habitat Alteration.**

The alteration of the habitat within a stream can have severe consequences. Whether it is the removal of the vegetation providing a root system network for holding soil particles together, the release of sediment, which increases the bed load and covers benthic life and fish eggs, the removal of gravel bars, “cleaning out” creeks with heavy equipment, or the impounding of the water in ponds and lakes, many alterations impair the use of the stream for designated uses. Habitat alteration also includes the draining or filling of wetlands.

Although large-scale public projects such as highway construction can alter significant portions of streams, individual landowners and developers are responsible for the vast majority of stream alterations.

Some measures that can help address these problems are:

*Voluntary Activities*

- Sponsor litter pickup days to remove litter that might enter streams
- Organize stream cleanups removing trash, limbs and debris before they cause blockage.
- Avoid use of heavy equipment to “clean out” streams. Instream work other than debris removal will require an Aquatic Resource Alteration Permit (ARAP).
- Plant native vegetation along streams to stabilize banks and provide habitat (Citico Creek).
- Encourage developers to avoid extensive use of culverts in streams.

*Regulatory Strategies*

- Restrict modification of streams by means such as culverting, lining, or impounding (Gillespie Springs Branch, McFarland Springs Branch, Citico Creek, Friar Branch, Mackey Branch).

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- Require mitigation for impacts to streams and wetlands when modifications are allowed.
- Require permitting of all rock harvesting operations.
- Increased enforcement may be needed when violations of current regulations occur, especially for illicit gravel dredging.

**6.3.B.vi. Acid Rock Drainage (ARD).**

Another source of pollution comes from abandoned and active mines as well as the disturbance of strata containing certain sulphide minerals such as those containing pyrite. For example, roads cut through certain types of rock layers can also contribute to the pollution of waters of the state. These streams are impacted by ARD, which causes the pH to drop to below 6.0.

Streams may be impacted by chemical reactions that result in orange flocculant material in the water and on the bottom of streams. Seeps may develop an oily film on the surface of the water. The orange color comes from the iron in the water precipitating out when the water reaches the surface and starts to oxidize. Once the iron has precipitated out, then other metals will start to precipitate, like manganese and aluminum (manganese forms a hard black coating on the substrate and aluminum a fine white chalky layer). Examples of streams affected by ARD in the Group 4 Portion of the Lower Tennessee River Watershed are North and South Suck Creeks, North Chickamauga Creek, and a number of its tributaries.

The means necessary to remove ARD from these streams is complicated and expensive. There are two types of treatment systems, Passive Treatment and Active Treatment. Two examples of Passive Treatment facilities are anoxic limestone drains and constructed wetlands (alone or in some combination lined with limestone rock). These systems are used to precipitate the flocculants and stabilize the pH. Active Treatment systems collect the water at the source and actively drop neutralizing chemicals into the water in order to stabilize the pH and precipitate iron prior to discharging to a stream. Since these treatment systems will have to go on for many years, the most cost effective means to treat these streams is by Passive Treatment. In order to install these systems the landowners, stakeholders and Office of Surface Mining all have to work together. Most of the streams in the North Chickamauga Creek watershed have passive treatment systems. Hogskin Branch is the one exception, due to its location.

Some of these problems can be addressed by:

***Voluntary Activities***

- Provide public education.
- Get stakeholders involved in the construction and maintenance of the wetlands.

***Regulatory Strategies***

- Mining (and some TDOT) activities covered by an NPDES or ARAP permit should have a longer period of post-termination monitoring and remediation as a requirement of permit issuance.

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Abandoned Coal Mines pose serious threats to public health, safety, and welfare as well as degrade the environment. The programs of Tennessee Land reclamation Section accomplish three important things: (1) They remove dangerous health and safety hazards that threaten the citizens of Tennessee, (2) They improve the environment, and (3) They restore resources to make them available for economic development, recreation, and other uses. Problems typically addressed by the Land reclamation Section include open or improperly filled mine shafts, dilapidated mine buildings and equipment, toxic mine refuse and drainage, landslides, mine fires, highwalls, and subsidence.

Projects on the ground:

- Standifer 3 and 6. A project to construct an acid mine drainage treatment system by Nickajack Lake.

**6.3.B.vii. Storm Water.**

MS4 discharges are regulated through the Phase I or II NPDES-MS4 permits. These permits require the development and implementation of a Storm Water Management Program (SWMP) that will reduce the discharge of pollutants to the maximum extent practicable and not cause or contribute to violations of state water quality standards. The NPDES General Permit for Discharges from Phase I and II MSF facilities can be found at:

<http://www.state.tn.us/environment/wpc/stormh2o/MS4.shtml>.

For discharges into impaired waters, the MS4 General Permit requires that SWMPs include a section describing how discharges of pollutants of concern will be controlled to ensure that they do not cause or contribute to instream exceedances of water quality standards. Specific measurements and BMPs to control pollutants of concern must also be identified. In addition, MS4s must implement the proposed waste load allocation provisions of an applicable TMDL (i.e., siltation/habitat alteration, pathogens) and describe methods to evaluate whether storm water controls are adequate to meet the waste load allocation. In order to evaluate SWMP effectiveness and demonstrate compliance with specified waste load allocations, MS4s must develop and implement appropriate monitoring programs.

Some storm sewer discharges are not regulated through the NPDES MS4 program. Strategies to address runoff from in these urban areas include adapting Tennessee Growth Readiness Program (TGRP) educational materials to the watershed. TGRP is a statewide program built on existing best management practices from the Nonpoint Education for Municipal Officials program and the Center for Watershed Protection. TGRP developed the program to provide communities and counties with tools to design economically viable and watershed friendly developments. The program assists community leaders in reviewing current land use practices, determining impacts of imperviousness on watershed functions, and allowing them to understand the economics of good watershed management and site design.